^{12}N β^+ decay:11.000 ms   1981Ka31,2009Hy01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. H. Kelley, J. E. Purcell and C. G. Sheu	NP A968, 71 (2017)	1-Jan-2017

Parent: ^{12}N: E=0.0; J^π=1$^+$; $T_{1/2}$=11.000 ms *16*; Q(β^+)=17338.1 *10*; %β^+ decay=100.0

^{12}N-Q(β^+): From (2017Wa10).

^{12}N-J^π,$T_{1/2}$: From Adopted Levels for ^{12}N in ENSDF database.

1972Al31: ^{12}N, measured $\beta\gamma$-coin. Deduced log ft, β^-branching.

1974Mc11: ^{12}N,measured E$_\beta$, I$_\beta$, $\beta\gamma$-coin. Deduced log ft.

1978Al01: ^{12}N,measured E$_\beta$, I$_\beta$, $\beta\gamma$-coin, T$_{1/2}$. Deduced β^-branching, mirror asymmetries, ft.

1981Ka31: ^{12}N, measured $\beta\gamma$-coin, $\beta\gamma$(t). Deduced I$_\beta$, log ft.

1988Na09: ^{12}N, measured I$_\beta$, I$_\gamma$, $\beta\gamma$-coin. Deduced mirror asymmetry. ^{12}B, ^{12}N deduced Gamow-Teller β^-decay branching ratio.

1990Ca10: ^{12}N(β^+), measured spectral shape factors.

1991Li32: ^{12}N, measured β^-decay asymmetry.

1993Mi32: ^{12}N(β^+), measured I$_\beta(\theta)$. Deduced alignment coefficients.

1998Mi14: ^{12}N(β^+), measured β^-ray angular distribution from oriented nuclei.

1998Se04: ^{12}N(β^+), measured β^+ polarization asymmetry from decay of polarized nuclei.

1999Mi41,2000Mi11: ^{12}N(β^+), measured E$_\beta$, I$_\beta(\theta)$ from aligned nuclei.

2001Th18: ^{12}N(β^+), measured positrons longitudinal polarization following decay.

2002BoZY: ^{12}N(β^+p), analyzed β^-delayed multi-particle emission data. Deduced branching ratios, decay mechanism features.

2002Fy02,2003Fy02,2003Fy04,2004Fy02,2004Fy03: ^{12}N(EC), measured β^-delayed E$_\alpha$, $\alpha\alpha$-coin. ^{12}C level deduced three-body decay mechanism, excited states.

2002Mi01,2002Mi03,2002Mi36,2002Mi49,2003Mi24: ^{12}N(β^+), measured E$_\beta$, angular distributions from spin-aligned sources.

2004Bo43: ^{12}N(β^+), measured β^-delayed particle spectra, yields. ^{12}C deduced excited states particle-decay features.

2009Di06: ^{12}N(β^+), measured E$_\alpha$, E$_\gamma$, $\alpha\alpha\alpha$-coin. ^{12}C deduced levels, J, π, triple-α continuum states and their decay modes. R-matrix analysis.

2009Hy01,2009Hy02,2010Hy01: ^{12}N(β^+), measured E$_\alpha$, I$_\alpha$, E$_\gamma$, I$_\gamma$, E$_\beta$, $\beta\gamma$-, $\beta\alpha$-, $\alpha\alpha\alpha$-coin. ^{12}C deduced levels, β feedings, and log ft.

The authors performed two measurements of ^{12}N decay into α unbound states of ^{12}C using two different techniques. In addition ^{12}B decay was also measured. The first method involved implantation of ^{12}N into a thin carbon foil located in the center of a large solid angle Si Strip array (at IGSOL/JYFL) that measured breakup α particle kinematics; a HPGe detector mesured the ^{12}C*(4.44 MeV) de-excitation gamma-rays, and the measurement was normalized to the value presently adopted in ENSDF. The second method involved implantation of ^{12}N into a thick Si detector (at TRIuP/KVI) and measuring the total 3α decay energy.

(2009Hy02) gives details of the JYFL measurement, while (2009Hy01) is reported as giving the most precise analysis of the KVI and JYFL measurements.

(2010Hy01) gives a detailed multi-channel multi-level R-matrix analysis of 0$^+$ and 2$^+$ levels above the E$_x$=7.65 MeV level that may contribute to the shape of the 3α energy spectrum observed in ^{12}B and ^{12}N decay to ^{12}C. The analysis focuses mainly on these higher-lying state and is difficult to fold in with the analysis given in (2009Hy01,2009Hy02). A significant difference from the prior work is the assumption that the E$_x$=10.3 MeV bump (J^π=0$^+$) is from interference; they suggest instead the J^π=0$^+_3$ state at E$_x$=11.2 MeV *3* with Γ=1.5 MeV *6*.

^{12}C Levels

E(level)	$J^{\pi\dagger}$	$\Gamma^\dagger$
0	0$^+$	
4439.82 *31*	2$^+$	10.8$\times$10^{-3} eV *6*
7654.07 *19*	0$^+$	9.3 eV *9*
10.3$\times$10^3 *3*	(0$^+$)	3.0 MeV *7*
12710	1$^+$	18.1 eV *28*
15110	1$^+$	43.6 eV *10*

† From Adopted Levels.

$^{12}N\,\beta^+$ decay:11.000 ms　　　1981Ka31,2009Hy01 (continued)

ε,β^+ radiations

E(decay)	E(level)	$I\beta^{+\dagger}$	$I\varepsilon^\dagger$	Log ft	$I(\varepsilon+\beta^+)^\dagger$	Comments
(2228.1 *10*)	15110	0.0023 *15*	4.×10^{-6} *3*	3.6 *3*	2.3×10^{-3} *15*	av Eβ=495.21 *45*; εK=0.001824 *5*; εL=0.0001020 *3* Iε: From average of (2009Hy01) and (1967Al03) See discussion in Table 12.42 of (2017Ke05).
(4628.1 *10*)	12710	0.120 *3*		3.924 *11*	0.120 *3*	av Eβ=1624.94 *49* Iε: Mainly from the KVI data in (2009Hy01). See other values in Table 12.42 of (2017Ke05).
(7.0×10^3 *3*)	10300	0.403 *9*		4.42 *11*	0.403 *9*	av Eβ=2.80×10^3 *15* Iε: From weighted average of 0.38 *5* (JYFL) and 0.404 *9* (KVI). In (2009Hy01) this is listed as the sum of feeding to E$_x$=9-12 MeV. See discussion in Table 12.42 in (2017Ke05). In (2010Hy01) the authors indicate that the J^π=0$_3^+$ resonance has parameters E$_x$=11.2 MeV *3* with Γ=1.5 MeV *6*, suggesting that the previously observed E$_x$=10.3 MeV bump results from interference. They further indicate that the J^π=2$_2^+$ resonance has parameters E$_x$=11.1 MeV *3* and Γ=1.4 MeV *4*. In addition, for these two states (2010Hy01) find B(>)=0.06 *2* and B(>)=0.05 *3* (log ft=4.82 *18* and log ft=4.90 *40*) for the J^π=0$_3^+$ and 2$_2^+$ states, respectively.
(9684.0 *10*)	7654.07	1.41 *3*		4.622 *10*	1.41 *3*	av Eβ=4113.48 *51* Iε: from (KVI) in (2009Hy01). See other values in Table 12.42 of (2017Ke05).
(12898.3 *11*)	4439.82	1.898 *32*		5.148 *8*	1.898 *32*	av Eβ=5711.13 Iε: Iβ(4440) is used as a global normalization in most measurements. Iε: We adopt Iβ=1.898 *32* from (1981Ka31) since the experimental approach aimed to overcome most systematic effects that influence the value. For other values see Table 12.23 in (2017Ke05).
(17338.1 *10*)	0	96.17 *5*		4.1106 *7*	96.17 *5*	av Eβ=7922.87 Iε: unity minus the sum of branching to higher states. See discussion in (2017Ke05) Table 12.42.

† Absolute intensity per 100 decays.

$\gamma(^{12}C)$

$E_\gamma^\dagger$	$I_\gamma^\ddagger$	E_i(level)	J_i^π	E_f	J_f^π	Comments
3213.8	5.9×10^{-4} *2*	7654.07	0$^+$	4439.82	2$^+$	I$_\gamma$: From $\Gamma\gamma/\Gamma$=(4.16 *11*)×10^{-4} and Iβ=(1.41 *3*)%.
4438.91	1.90 *3*	4439.82	2$^+$	0	0$^+$	

† From Adopted Gammas.
‡ Absolute intensity per 100 decays.

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Decay Scheme

Intensities: I_γ per 100 parent decays

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$

			$I\beta^+$	$I\varepsilon$	Log ft

1^+ 0.0   11.000 ms 16

$\%\varepsilon + \%\beta^+ = 100$ $Q^+ = 17338.1$ 10

$^{12}_{7}N_{5}$

			$I\beta^+$	$I\varepsilon$	Log ft
1^+	15110		43.6 eV 10	0.0023 $4.\times10^{-6}$	3.6
1^+	12710		18.1 eV 28	0.120	3.924
(0^+)	10300		3.0 MeV 7	0.403	4.42
0^+	7654.07		9.3 eV 9	1.41	4.622
2^+	4439.82		10.8×10^{-3} eV 6	1.898	5.148
0^+	0			96.17	4.1106

3213.8 0.00061

4438.91 1.90

$^{12}_{6}C_{6}$